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DETERMINING THE SIGN (POSITIVE) OF THE CHARGE OF PRIMARY PARTICLES OF COSMIC RAYS BY MEASURING THE AZIMUTH ASYMMETRY IN THE STRATOSPHERE IN THE REGION OF THE EQUATOR

S. N. Vernov, N. L. Grigorov, N. A. Dobrotin, S. P. Sokolov, F. D. Savin, and A. I. Kurakin, Moscow State Univ imeni M. V. Lomonosov and the Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR

/A Digest/

The charges of primary particles can be determined as to sign by measuring azimuth asymmetry in the stratosphere near the magnetic equator. The presence of this asymmetry was proved by Johnson, Rossi, and Korff (1) in their study of the west-east azimuth asymmetry at sea level and on mountain tops. However, no definite conclusion resulted from these experiments on the sign of primary particles and their nature since the particles reaching the measuring device in these experiments were of secondary or even tertiary derivation. In order to decrease the influence of secondary processes upon the azimuth asymmetry, asymmetry must be measured at high altitudes where primary cosmic radiation makes up a substantial percent of the total number of particles. Azimuth asymmetry in the stratosphere has been measured by Johnson and Barry (2). Their measurements revealed practically no azimuth asymmetry at altitudes of 20-25 kilometers; it constituted 7 percent, whereas it should have constituted 60 percent of all the primary particles has a positive charge, according to Johnson's calculations.

Johnson, from his experiments in measuring azimuth asymmetry at sea level, concluded that all primary particles are positively charged, i.e., are protons. The very small azimuth asymmetry observed by Johnson in the stratosphere is explained in a number of works by the fact that secondary particles do not retain the direction of primary particles. A. M. Kulikov's (3) experiments, however, showed that the dispersion of secondary particles is small and does not even come close to a value capable of decreasing azimuth asymmetry from 60 to 7 percent. Thus, from Johnson's and Barry's experiments, taken together with those of Kulikov, the conclusion follows that particles

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with negative charge make up a high percent of primary cosmic radiation. Moreover, these particles cannot be electrons, since S. N. Vernov's experiments (with collaborators) (4) showed that there is no noticeable number of electrons in the composition of primary particles. Consequently, we must admit the existence of negative nonelectronic particles, i.e., hypothetical antiprotons.

Thus, the sign of the charge of primary cosmic particles remained an unsolved problem. In order to solve this problem decisively, we devised a special instrument which was lifted to the stratosphere in sounding balloons. The basic part of the instrument was a telescope inclined 60 degrees to the vertical. The number of particles counted by the telescope was transmitted by radio to a receiving point, where it was recorded in the same manner as in previous works (4). Since the instrument suspended in the sounding balloon rotated in various directions during flight, it was necessary to maintain the telescope in a definite direction alternately, either east or west, in order to measure west-east asymmetry. This was achieved by fastening three photoelements firmly to the telescope. The planes of two photoelements were parallel and placed so that sunlight could fall on only one of the photoelements. Each of the photoelements was connected with the grid of its tube, whose plate circuit included a small relay. When, due to the rotation of the unit, sunlight fell on one of the photoelements, the relay was activitated, and its contacts closed the circuit to a small electric motor. The electric motor turned the telescope until the sunlight fell on neither of the photoelements. The relay then opened the circuit to the motor and rotation of the telescope stopped. In this fashion, a definite orientation of the telescope with respect to the sun was maintained. A correction for the change in the azimuth of the sun was provided for with the aid of a small time mechanism which turned the photoelements.

The accuracy with which the fixed direction of the telescope was maintained at sea level was $\pm$ 15 degrees, and must have been much greater in the stratosphere because of increased solar intensity.

In addition to the triple coincidences selected by the telescope, the number of showers was also measured simultaneously in the unit. This number characterized the shower-forming properties of the radiation coming from the west and east. The showers were registered by a four-coincidence circuit, which was triggered for simultaneous discharge in counters 1, 2, and 3 of the telescope and one of the other counters.

The resolving power (time) of the triple-coincidence circuit was $\tau = 2.10^{-6}$ seconds; the resolving power of the four-coincidence circuit was $t = 3.10^{-6}$ seconds; Every guadruple coincidence was recorded on tape at the receiving point.

Triple coincidences operated an electromagnetic indicator with an arrow on a disc having contacts. When the electromagnetic indicator had counted a definite number of pulses (90 in the case of telescope without lead and 45 in the case of a telescope with lead), the telescope was rotated through 180 degrees, i.e, from west to east or vice versa, and this position was maintained in the manner described until the electromagnetic indicator had counted a definite number of pulses, after which the telescope was again rotated through 180 degrees, etc. An audiofrequency corresponding to each position of the telescope was received at the receiving point; thus the time the telescope stayed in the west and east directions was fixed at the receiving point. This also made it possible to determine whether the automatic device for maintaining a definite telescope direction was operating correctly.

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Azimuth asymmetry was measured on board a Diesel-motor ship at geomagnetic latitude 6-10 degrees south. Five instruments were sent up, three to measure the asymmetry of total intensity and two with 8 centimeters of lead between the telescope counters to measure asymmetry of the hard component. The instruments operated normally during the flights, and the results obtained in different flights agreed well.

We obtained curves for total intensity of cosmic rays, the points on the curves being the averages of three flights. The curves for intensity of the hard component in west and east directions were shown similarly. The points are the averages of two flights. The amount of matter (thickness), in grams per square centimeter, between the upper boundary of the atmosphere and the balloon is placed along the abscissa. The curves showed that $\gamma = 2(2N_W - N_E)$ $(N_W + N_E)$, namely the coefficient characterizing the azimuth asymmetry of the total intensity, reaches 45-50 percent at high altitudes. The azimuth asymmetry of the hard component reaches 70 percent at high altitudes. The conclusion drawn from these measurements is that primary cosmic radiation consists of positively charged particles. Moreover, the high asymmetry of the total intensity is an indication of the comparatively small loss of direction by the secondary particles. The absence of antiprotons in the composition of primary radiation is especially apparent from the high asymmetry of the hard component.

As was indicated previously, these same instruments also measured with respect to altitudes the behavior of showers caused by particles of the hard component. The results obtained indicated a substantial difference in the altitudinal behavior of showers near the geomagnetic equator and at a latitude of 50 degrees North.

Thus, our experiments established the high east-west asymmetry in the stratosphere, which proves that the charge of primary particles is positive.

BIBLIOGRAPHY

1. T. H. Johnson, Phys. Rev., 43, 834, 1933; B. Ross, Phys, Rev., 45, 212, 1934; S. A. Korff, Phys. Rev,, 44, 515, 1933.

2. T. Johnson and J. Barry, Phys. Rev., 56, 219, 1939.

3. S. N. Vernov and A. M. Kulikov, DAN, 61, No 6, 1948

4. S. I. Brikker, S. N. Vernov, I. M. Yevreynova, S. P. Sokolov, and T. N. Charakch'yan, DAN, 57, No 2, 1947.

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